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PATENT APPLICATION
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ENHANCEMENT TECHNIQUE FOR ASYMMETRICAL PRINT RESOLUTION

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Drawings

Figs. 1A and 1B show a printer for the invention.

Fig. 2 shows a carriage for the printer

Fig. 3 shows a preferred print cartridge for the carriage

Figs. 4A, 4B and 4C show a flow chart.

Fig. 5 is a block diagram for the flow chart.

Figs. 6-9 show examples of how the flow chart operates.

Detailed Description of Exemplary Embodiments of the Invention

A typical embodiment of the invention is exemplified in a large format color inkjet printer/plotter as shown in Figs. 1A-1B. More specifically, Fig. 1A is a perspective view of an inkjet printer/plotter 210 having a housing 212 mounted on a stand 214. The housing has left and right drive mechanism enclosures 216, 218. A control panel 220 is mounted on the right enclosure 218. A carriage assembly 300, illustrated in phantom under a cover 222, is adapted for reciprocal motion along a carriage bar 224, also shown in phantom. The position of the carriage assembly 300 in a horizontal or carriage scan axis is determined by a carriage positioning mechanism 310 with respect to an encoder strip 320 (see Fig. 1B). A print medium 330 such as paper is positioned along a vertical or media axis by a media axis drive mechanism (not shown). As used hereing the media axis is called the X axis denoted as 201, and the carriage scan axis is called the Y axis denoted as 301.

Fig. 1B is a perspective view of the carriage assembly 300, the carriage positioning mechanism 310 anmd the encoder strip 320. The carriage positioning mechanism 310 includes a carriage position motor 312 which has a shaft 314 which drives a belt 324 which is secured by idler 326 and which is attached to the carriage 300.

The position of the carriage assembly in the scan axis is determined precisely by the encoder strip 320. The encoder strip 320 is secured by a first stanchion 328 on one end and a second stanchion 329 on the other end. An optical read 366 is disposed on the carriage assembly and provides carriage position signals which are utilized by the invention to achieve optimal image registration in the manner described below.

Referring to Fig. 2, a carriage 102 is slidably mounted on support bar 172 through a bearing sleeve 171, and includes four slots 121, 123, 125, 127 for removably receiving four inkjet print cartridges. From right to left in the carriage slots are respectively mounted a black ink cartridge 120, a magenta ink cartridge 122, a cyan ink cartridge 124 and a yellow ink cartridge 126. Although the invention has been successfully demonstrated with four 300 dpi print cartridges of the type shown in Fig. 2 (see also Fig. 14), in a currently preferred embodiment the black ink cartridge has a 600 dpi nozzle resolution and therefore prints 600 dpi sized drops which require no depletion (see the area fill comparison in Fig. 17).

Referring to Fig. 3, a modified carriage 102a carries a removably mounted black ink cartridge 130, and a tri-compartment ink cartridge 132 which has separate ink reservoirs 133, 134, 136 for cyan, magenta and yellow ink, respectively.

The embodime[illegible] described herein employ[illegible] new technique which allows an inkjet printer system to print A x B resolution monochrome bitmaps where A=B in a system where A dpi is addressable in the carriage scan axis and B/2 dpi is addressable in the media advance axis. Thus, the present system and methods may be used with asymmetrical sub-pixels that are only half as wide in the X direction as they are in the Y direction.

The embodiments herein enable an inkjet printer system to utilize only the even width lines while preserving both edges without losing its ability to render one-pixel width lines. This enables it to keep the smallest detail in a bitmap image.

The present systems and methods may be accomplished in the steps illustrated in Figure

As shown in Figure 1, the present systems and methods may be accomplished in three steps. First, the AxB bitmap is processed by a narrowing process

Referring again to Figure 1, the next step is a logical combining 202 of rows of the pixel grid. In taking an A x A bitmap and converting it to a A x A/2 bitmap for printing, a

problem faced was that for certain images some horizontal rows would be lost and not shown on the final A x A/2 image. To solve this problem, several rows of data were taken together and a logical operation was performed on the rows such that no horizontal row would be removed while following through the process as shown and described in relation to Figures 1-X. The logical combination of rows 202 ensures that the resulting row from the operation will have information from at least one of the rows involved in the operation and that no information will be lost.

The object of the logical combination step 202 is to downscale the raster of the image (not reduce the ink) in the vertical axis without losing information. It is necessary with the present systems and methods to downscale in order to be able to work in an asymmetric writing system (where A != B). Accordingly, the goals of this stage are different than other systems because the present embodiments are preparing a raster to be printed on an asymmetric system. Because the goals are different, the procedure also, as expected, will also be different.

In other systems two rows were worked with and processed at the same time.

In the present embodiments, there is no need to deplete in the vertical axis, because the system is only B=A/2 addressable. Accordingly, it is not possible to put double ink. With the present systems the goal is then opposite of the other systems because with the present system, the logical combination step 202 serves to add pixels instead of deplete pixels. The combination step 202, in current design, works with three rows at the same time, instead of two rows like some other systems have and currently do. The present system identifies isolated objects which would be lost in the media advance axis direction, directly related to the media advance axis resolution. Then, the present system moves these isolated objects one row upwards such that the isolated object will not not lost.

The final step as shown is a horizontal depletion step 204. This horizontal depletion step 204 is the same as the depletion methods as described earlier except that the depletion is applied only in the horizontal direction, that is, only in the carriage scan axis and not in the media advance axis. The horizontal depletion step 204 also preserves both the horizontal edges and the vertical edges.

By using the method and steps as described, the present embodiments are able to assume a 1200 x 1200 image in the rendering stage and produce a 1200 x 600 dpi image for the writing stage without losing any resolution for one-pixel width lines. Of course, the 1200 dpi is in the scan axis and the 600 dpi is in the paper axis.